METHOD FOR CONTROLLING THE OFFERING OF AT LEAST ONE ADDITIONAL TRANSMISSION CHANNEL AS ACCESS TO A PACKET-SWITCHING NETWORK

The invention is directed to a method for controlling the offering of at least one additional transmission channel as access to a packet-switching network according to the preamble of patent claim 1.

In accord therewith, the following, known network constellation forms the basis, this being shown, for example, on page 7 of a customer brochure "EWSD goes Internet" of Siemens AG, published in 1997 as matter number A50001-N2-P65-2-7600.

A subscriber of a traditional line-switching telephone network who would like to use services of a packet-switching network, for example of the Internet, receives access to the packet-switching network in that he dials in to the packet-switching network at an access node connected to the digital telephone switching center using his subscriber terminal device, for example a personal computer or, respectively, a telephone set that is connected to a digital telephone switching center either directly or indirectly via a private branch exchange, and sets up a connection to a destination node of the packet-switching network, for example a computer of a service vendor with, for example, the assistance of a browser and also requests services from such a computer.

Requested services such as, for example, video on demand, voice over IP or video conference circuits require a high a guaranteed transmission bandwidth as well as insignificant delay.

With respect to the Internet, two approaches under the names "Integrated Services" and 'Differentiated Services" are currently under discussion, these guaranteeing the required transmission bandwidth and little delay in the transmission of the data belonging to such services.

The first approach, "Integrated Services", is supported on an IP signalling protocol, for example RSVP (resource reservation protocol; "RFC Document No. RFC 2205, authored by R. Braden, L. Zhang, S. Berson, S. Herzog, S. Jamin,

published by the Internet Engineering Task Force in September 1997, Internet page: http://info.internet.isi.edu:80/in-notes/rfc/files/rfc2205.txt). In accord therewith, a connection is set up between an originating and, respectively, a destination node of the Internet by an exchange of data packets with exclusive signalling function, and the transmission bandwidth between the originating and the destination node is defined, in particular, for the payload packets of a requested service. This connection can is turn be cleared down by data packets having an exclusive signalling function. Alternatively thereto, the connection can be ended when no data packets with exclusive signalling function that are responsible for maintaining the connection are transmitted between the originating and destination node for a defined time duration.

The second approach, "Differentiated Services" ("Internet Draft" document, authored by K. Nichols and S. Blake, published by the Internet Engineering Task Force in February 1998, Internet page: http://www.ietf.org/internet-draft/draft-nichols-dsodef-00.txt), proposes a method that enables an accelerated transmission of data packets from an originating node to a destination node. Respectively specific bits of what is referred to as the TOS byte are set in the header of the data packets for data packets that belong to a service requesting a high transmission bandwidth. According to the bits set in the TOS byte, the data packets are handled with priority in the transit nodes via which such data packets are transmitted from the originating to the destination node, as a result whereof, in particular, an accelerated forwarding to the next transit or destination node is achieved, i.e. nearly without delay.

With respect to the line-switching (telephone) network, there are currently various possibilities for increasing the transmission bandwidth on the transmission link between an access node and a subscriber terminal device, this currently amounting to a maximum of 56 kbit/s given an analog subscriber terminal and 64 kbit/s given an ISDN subscriber terminal without channel bundling.

One possibility for achieving a higher transmission bandwidth for such services is what is referred to as the multi-link PPP protocol ("RFC-Document" No. RFC 1990, authored by K. Sklower, B. Lloyd, G. McGregor, D. Carr and T. Coradetti, published by the Internet Engineering Task Force in August 1996, Internet

page: http://info.internet.isi.edu:80/in-notes/rfc/files/rfc1990.txt), which represents an expansion of the PPP protocol that controls the communication between an access node to the Internet and a subscriber terminal device. Assuming that a plurality of connections via a plurality of transmission channels (for example, given an ISDN basic access: 2 B-channels at 64 kbit/s and 1 D-channel at 16 kbit/s or, given an ISDN primary multiplex access, 30 B-channels and 1 D-channel at 64 kbit/s each) can be set up from such an access node to a subscriber terminal device, an offering of additional transmission channels for a transmission link in common with the already existing transmission channel produces a connection with an enhanced transmission bandwidth (of, for example, 128 kbit/s given an ISDN basic access or, respectively, of approximately 2 Mbit/s given an ISDN primary multiplex access) between the subscriber terminal device and the access node.

In this method, however, only the subscriber can decide about the offering and the release of such transmission channels. As a result thereof, this procedure is very static. Moreover, the subscriber incurs higher charges due to the offering of at least one additional transmission channel, regardless of whether an additional transmission channel is needed for increasing the transmission bandwidth or not.

Another approach for controlling such an offering and release of additional transmission channels is realized with what is referred to as the "Always On/Dynamic ISDN" technique (AO/DI) (for example, Technical Memo: "Always On/Dynamic ISDN", authored by A. Kuzma, published in October 1997, Vendors' ISDN Association Inc., 2694 Bischop Drive, Suite 105, San Ramon, CA 94583). This method provides that a plurality of B-channels are interconnected upon employment of the multi-link PPP protocol in ISDN. A narrowband, permanent virtual connection with, for example, 9.6 kbit/s transmission bandwidth to the Internet is offered via a D-channel, the transmission bandwidth thereof being capable of being expanded as needed by the addition of B-channels (for example, 128 kbit/s given an ISDN basic access).

The AO/DI technique uses what is referred to as the BAP/BACP protocol ("RFC Document" Number RFC 2125, authored by C. Richards and K. Smith, published by the Internet Engineering Task Force in March 1997, Internet page:

http://info.internet.isi.edu:80/in-notes/rfc/files/rfc2125.txt) in order to enable the communication with respect to the offering and release of such transmission channels between a subscriber terminal device and the access node to the Internet. For example, an ISDN subscriber would like to use a B-channel that is already occupied with data belonging to a requested service for telephoning. The control of the offering and release of such a transmission channel is thereby dependent on actions of the subscriber.

The critical disadvantage of such a control exclusively dependent on the actions of the subscriber has already been presented above.

Moreover, the offering or, respectively, release of transmission channels with the assistance of the AO/DI technique is dependent on certain traffic parameters. For example, additional transmission channels can thus be offered when there is a high volume of data to be transmitted in the access node. Conversely, transmission channels are in turn released given a low traffic volume in the access node.

Since the data packets are transmitted connectionless in a packet-switching network such as, for example, the Internet, i.e. the data packets belonging to a connection are communicated independently of one another, without sequence guarantee and without reception confirmation, the traffic volume in such an access node fluctuates greatly and is therefore difficult to estimate. There is thereby the risk that, given a low traffic volume in the access node, the transmission channels additionally offered for a connection are undesirably released and data packets are therefore lost. For example, an unwanted release of additionally offered transmission channels occurs when both subscribers in an Internet voice connection (voice over IP) between two subscribers happen not to talk for a couple of seconds.

The AO/DI technique thus leads to an uncontrolled adaptation of the transmission bandwidth that is made available by offering or, respectively, releasing additional transmission channels for the transmission of the data belonging to a service requested by the subscriber.

Moreover, the permanently existing connection to the access node via the D-channel is unfavorable and not only for cost reasons. This connection leads to a

low transmission bandwidth available to the signalling traffic, so that a massive data backup can arise given an increased signalling traffic volume.

The object of the invention is comprised in fashioning a method of the species indicated in the preamble of patent claim 1 to the effect that the offering of additional transmission channels is controlled optimally dynamically and controlled as well as optimally cost-beneficial at the same time.

This object is achieved by the features recited in the characterizing part of claim 1.

The principle underlying the invention is comprised therein that the access node recognizes data packets separately identified with a traffic information among all incoming data packets. Those data packets that belong to a service requested by the subscriber for which an increased transmission bandwidth is required are thereby separately identified with a traffic information. According to the traffic information, the access node initiates the offering of at least one additional transmission channel for the purpose of a connection with at least one already existing transmission channel to form a common transmission link between the access node and at least one such subscriber terminal device or, respectively, private branch exchange.

The invention is particularly distinguished by a completely controlled dynamic control of the offering of an adequate number of transmission channels. Inventively, the offering of at least one additional transmission channel is made dependent of the transmission bandwidth that is required for a requested service and that is contained in the traffic information. Actions on the part of a subscriber that control the offering of at least one additional transmission channel are not necessary. Moreover, such a dynamic control controlled by the traffic information minimizes the charges incurred by the offering of at least one such additional transmission channel and billed to the subscriber requesting the service.

Further developments of the invention are characterized in subclaims.

An advantageous development of the invention relates to the release of at least one such additional transmission channel. The access node can produce such a release after recognizing an incoming data packet separately identified with a disconnect information. The explicit signalling of the release of at least one such

additional transmission channel in the form of a disconnect information prevents the unwanted termination of the offering of at least one such additional transmission channel.

An alternative development of the invention provides that the access node can produce a release of at least one such additionally offered transmission channel when no data packets separately identified with a traffic information are received and recognized in the access node within a predetermined time duration. As a result thereof, the end of such an offering of at least one such additional transmission channel can be assured with little implementation outlay.

According to a useful development of the invention, such a traffic information is contained in a bit pattern in the header of such a data packet. As a result thereof, the data packets can be designationally and, thus, quickly investigated for such a traffic information.

Another development of the invention that is advantageous in this context provides that such a bit pattern communicates the plurality of transmission channels to be additionally offered. In this way, the access node is relieved of the decision about the plurality of additionally required transmission channels to be made on the basis of the bit pattern.

Alternatively to the aforementioned development, such a traffic information can be communicated by a data packet having only a signalling function. This is particularly advantageous because additional transmission channels can already be offered after the arrival thereof in the access node before payload packets are transmitted.

Another advantageous development of the invention is comprised therein that a data packet separately identified with a traffic information can influence the charge calculation of the additionally offered transmission channels. In this way, the charges that are incurred with the offering of such additional transmission channels are not automatically billed to the subscriber.

An exemplary embodiment of the invention is described in greater detail below with reference to a drawing.

The Figure shows an exemplary network constellation to which the inventive method can be applied.

In accord therewith, subscriber terminal devices TLN, for example a telephone set or personal computer, are connected via a subscriber line to a line-switching network, normally the public telephone network. Such subscriber terminal devices can also be connected to a private branch exchange that has a connection to the line-switching network. There is at least one digital telephone switching center VST in the line-switching network, at least one access node POP to the packet-switching network PN being connected thereto. Such an access node can also be integrated into a digital telephone switching center. Within the packet-switching network PN, an originating or, respectively, destination node UZ -- dependent on the view of the transmission direction -- is indicated, this being in communication with the access node either directly are via a transit node (not shown in the Figure). For example, such an originating or, respectively, destination node indicates a computer of a service vendor. In order to set up a connection between the subscriber terminal devices and the access node, it is conceivable to offer a plurality of transmission channels.

The following scenarios can be imagined according to the inventive method:

A subscriber who has set up a connection via the digital telephone switching center in the line-switching network and via the access node to a destination node UZ, for example a computer of a service vendor of the packet-switching network, for example the Internet, requests a service requiring a guaranteed, high transmission bandwidth. The computer of the service vendor sends a data packet with exclusive signalling function to the subscriber terminal device, said data packet containing a reservation offer, preferably according to the initially cited RSVP protocol. Upon initiation of the subscriber or of an application program used by the subscriber, the subscriber terminal device sends a data packet with exclusive signalling function back in the direction to the computer of the service vendor, said data packet containing a traffic information in the form of a reservation for, for example, 80 kbit/s. When this data packet arrives in the access node and is recognized by the access node, the access node interprets the

traffic information of the data packet and forwards the data packet to the computer of the service vendor. The access node initiates the offering of at least one further transmission channel for the purpose of a connection with the already existing transmission channel to form a common transmission link between the access node and the subscriber terminal device. The data belonging to the requested service can now be transmitted on at least two transmission channels between the subscriber terminal device and the access node. Dependent on the content of the traffic information, one additional B-channel can be offered in the case of an ISDN basic access and up to 30 B-channels can be offered given an ISDN primary multiplex access.

Alternatively thereto, the offering of at least one additional transmission channel, for example in the form of a B-channel, can wait to be initiated until the payload packets belonging to the requested service arrive in the access node.

A release of at least one such additionally offered transmission channel is produced by the access node when data packets having an exclusive signalling function and provided with disconnect information that have been sent either by the subscriber terminal device or by the computer of the service vendor arrive in the access node and are recognized by it.

Another possibility for releasing such an additional transmission channel is comprised therein that the access node initiates such a release when no data packets identified with a traffic information intended for maintaining the additionally offered transmission channel are received and recognized in the access node within a predetermined time duration.

Alternatively to the above-described scenario, the following scenario is also conceivable.

After a subscriber has requested a service with high transmission bandwidth at the computer of a service vendor, the computer sends the payload packets belonging to this service in the direction toward the subscriber terminal device, said payload packets being identified with a traffic information in the form of a bit pattern in the header that corresponds to the requested transmission bandwidth. Such a bit pattern can preferably be located in the initially cited TOS byte. The value

of such a bit pattern thereby corresponds to the required transmission bandwidth and/or to the plurality of transmission channels to be additionally offered. After the arrival and recognition of such identified data packets in the access node, the access node initiates the offering of at least one further transmission channel. The access node produces the release of at least one such additionally offered transmission channels [sic] when no data packets identified with such a traffic information arrive at and are recognized in the access node within a defined time duration.

The above-described scenarios are to be viewed not only in isolation. On the contrary, the can be combined with one another. For example, a subscriber would like to request a plurality of services simultaneously from the computers of the service vendors. The offering of an additional transmission channel for the data of a first requested service can, for example, be occasioned by the data packets with exclusive signalling function mentioned in the first scenario. For another requested service, an additional transmission channel can be offered on the basis of the payload packet mentioned in the second scenario that is identified with a traffic information. The decision about how many additional transmission channels are made available occurs either on the basis of a separate evaluation of the traffic information in a data packet with exclusive signalling function and the traffic information in the header of a payload packet or on the basis of a evaluation in common of all traffic information available in the access node.

Further, the inventive method can run parallel to further methods, preferably the initially cited multi-link protocol or the AO/DI technique, or can be combined with them analogous to that set forth above. In particular, the inventive method does not preclude that an action by a subscriber triggers the offering of at least one additional transmission channel or the release of at least one such channel. This applies, for example, when a subscriber would like to use a transmission channel that is already occupied for the transmission of data belonging to a requested service for telephoning.

Further, the data packets separately identified with a traffic information can influence the charge assessment of the additionally offered transmission channels. Instead of billing the subscriber that requests a service for the charges of the

additionally offered transmission channel, another party, for example the service vendor, can partly or entirely assume the charges.